

## What is claimed is:

[Claim 1] 1. A video decoding method for predicting a current block of a picture comprising:

storing at least one previous product in a memory, wherein the previous product corresponds to a block of a plurality of blocks of the picture, and the previous product is the product of a quantized AC coefficient and a quantization scale of the block that the previous product corresponds to; determining which block to use as a prediction block from the plurality of blocks; reading from the memory at least one previous product corresponding to the prediction block; and calculating at least one quantized AC coefficient of the current block using the at least one previous product read from the memory.

[Claim 2] 2. The method of claim 1 wherein each quantized AC coefficient is a discrete cosine transform coefficient corresponding to a quantization operation.

[Claim 3] 3. The method of claim 1 wherein the at least one previous product is generated during an inverse quantization operation of the block to which the previous product corresponds.

[Claim 4] 4. The method of claim 3 wherein each quantized AC coefficient is the quantized AC coefficient  $QF[v][u]$  corresponding to the indexes  $[v, u]$ , the quantization scale is the quantization scale  $QP$ , and the method further comprises: transforming the quantized AC coefficient  $QF[v][u]$  into a second order intermediate coefficient  $F''[v][u]$  during the inverse quantization operation using one of the following operation equations:

(a). a first quantization method:

$$F''[v][u] = \begin{cases} 0, & \text{if } QF[v][u] = 0 \\ ((2 \times MP[v][u] + k \times QP) \times W[w][v][u]) / 16, & \text{if } QF[v][u] \neq 0 \end{cases}$$

wherein  $k = \begin{cases} 0, & \text{intra block} \\ \text{Sign}(QF[v][u]), & \text{non - intra block} \end{cases}$

wherein the index w of the weighted matrix  $W[w][v][u]$  is equal to 0 or 1, the values corresponding to an intra coded block and a non-intra coded block respectively, and the function  $\text{Sign}(x)$  is defined as follows:

$$\text{Sign}(x) = \begin{cases} 1, & x \geq 0 \\ -1, & x < 0 \end{cases}$$

; or

(b). a second quantization method:

$$|F''[v][u]| = \begin{cases} 0, & \text{if } QF[v][u] = 0 \\ (2 \times |MP[v][u]| + QP), & \text{if } QF[v][u] \neq 0 \text{ and } QP \text{ is odd} \\ (2 \times |MP[v][u]| + QP) - 1, & \text{if } QF[v][u] \neq 0 \text{ and } QP \text{ is even} \end{cases}$$

$$F''[v][u] = \text{Sign}(QF[v][u]) \times |F''[v][u]|$$

wherein the product  $MP[v][u] = QF[v][u] * QP$ , the at least one previous product is a sub set of the products  $MP[v][u]$  with the indexes [v, u] varied, and the function  $\text{Sign}(x)$  is defined as follows:

$$\text{Sign}(x) = \begin{cases} 1, & x \geq 0 \\ -1, & x < 0 \end{cases}$$

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**[Claim 5]** 5. The method of claim 1 wherein when the block determined to be used as the prediction block is outside a boundary of either a video object plane or a video packet corresponding to the picture, the method directly resets a prediction term of the quantized AC coefficient of the current block as zero to calculate the quantized AC coefficient of the current block rather than reading the at least one previous product of the prediction block from the memory.

[Claim 6] 6. The method of claim 1 wherein the prediction block is a left adjacent block or an upper adjacent block of the current block.

[Claim 7] 7. The method of claim 6 wherein when the prediction block is a left adjacent block of the current block, the memory is a register of a pipeline-based circuit.

[Claim 8] 8. The method of claim 1 wherein each quantized AC coefficient is the quantized AC coefficient  $QF[v][u]$  corresponding to the indexes  $[v,u]$ , and the quantization scale is the quantization scale  $QP$ .

[Claim 9] 9. The method of claim 8 wherein when the prediction block is a left adjacent block (A) of the current block, the at least one previous product read is a product  $MP_A[v] = QF_A[v][0] * QP_A$  corresponding to the left adjacent block, wherein  $QF_A[v][0]$  is a first column quantized AC coefficient of the left adjacent block (A) and  $QP_A$  is a quantization scale of the left adjacent block (A); and when the prediction block is an upper adjacent block (C) of the current block, the at least one previous product read is a product  $MP_C[u] = QF_C[0][u] * QP_C$  corresponding to the upper adjacent block, wherein  $QF_C[0][u]$  is a first row quantized AC coefficient of the upper adjacent block (C) and  $QP_C$  is a quantization scale of the upper adjacent block (C).

[Claim 10] 10. The method of claim 9 wherein when the prediction block is a left adjacent block of the current block, the quantized AC coefficient  $QF_X[v][0]$  of the current block (X) equals to  $PQF_X[v][0] + MP_A[v] // QP_X$ , wherein  $QF_X[v][0]$  is a first column quantized AC coefficient of the current block (X); when the prediction block is an upper adjacent block (C) of the current block, the quantized AC coefficient  $QF_X[0][u]$  of the current block (X) equals to  $PQF_X[0][u] + MP_C[u] // QP_X$ , wherein  $QF_X[0][u]$  is a first row quantized AC coefficient of the current block (X); and the quantization scale  $QP_X$  is a quantization scale of the current block,  $PQF_X[v][0]$  and  $PQF_X[0][u]$  are inverse scan calculation

results generated during a previous stage decoding process of the current block, and the operator  $//$  denotes a division operation with the result thereof rounded to the nearest integer.

[Claim 11] 11. The method of claim 10 wherein the calculating step further comprises: calculating at least one first column quantized AC coefficient  $QF_x[v][0]$  or at least one first row quantized AC coefficient  $QF_x[0][u]$  of the current block using the at least one previous product  $MP_A[v]$  or  $MP_C[u]$  read; the method further comprises:

performing a saturation operation of the quantized AC coefficient  $QF[v][u]$ , so the quantized AC coefficient  $QF[v][u]$  of the current block can be saturated in a predetermined numerical interval.

[Claim 12] 12. The method of claim 1 wherein the calculating step further comprises: calculating at least one first column quantized AC coefficient or at least one first row quantized AC coefficient of the current block using the at least one previous product read; the method further comprises:

performing a saturation operation of the quantized AC coefficient, so the quantized AC coefficient of the current block can be saturated in a predetermined numerical interval.

[Claim 13] 13. A video decoding device for predicting a current block of a picture comprising:

a storage device for storing at least one previous product, wherein the previous product corresponds to a block of a plurality of blocks of the picture, and the previous product is the product of a quantized AC coefficient and a quantization scale of the block that the previous product corresponds to;

a divider electrically connected to the storage device for reading at least one previous product of a prediction block from the plurality of blocks, for

reading a quantization scale of the current block, and for dividing at least one previous product of the prediction block by a quantization scale of the current block to generate a quotient and a remainder corresponding to each of the at least one previous product;

a rounder electrically connected to the divider for converting the quotient into a rounded quotient according to the quotient and the remainder; and

an adder electrically connected to the rounder for adding the rounded quotient with the inverse scan operation result generated during a previous decoding process of the current block to generate a summation;

wherein the summation is a first column quantized AC coefficient or a first row quantized AC coefficient of the current block.

[Claim 14] 14. The device of claim 13 wherein each quantized AC coefficient is the quantized AC coefficient  $QF[v][u]$  corresponding to the indexes  $v, u$ , and the quantization scale is the quantization scale  $QP$ .

[Claim 15] 15. The device of claim 14 wherein when the prediction block is a left adjacent block (A) of the current block, the at least one previous product read by the divider is a product  $MP_A[v] = QF_A[v][0] * QP_A$  corresponding to the left adjacent block, wherein  $QF_A[v][0]$  is a first column quantized AC coefficient of the left adjacent block (A) and  $QP_A$  is a quantization scale of the left adjacent block (A); and when the prediction block is a upper adjacent block (C) of the current block, the at least one previous product read by the divider is a product  $MP_C[u] = QF_C[0][u] * QP_C$  corresponding to the upper adjacent block, wherein  $QF_C[0][u]$  is a first row quantized AC coefficient of the upper adjacent block (C) and  $QP_C$  is a quantization scale of the upper adjacent block (C).

[Claim 16] 16. The device of claim 15 wherein when the prediction block is a left adjacent block of the current block, the quantized AC coefficient  $QF_X[v][0]$  of the current block (X) equals to  $PQF_X[v][0] + MP_A[v] // QP_X$ , wherein  $QF_X[v][0]$  is a first column quantized AC coefficient of the current block (X); when

the prediction block is a upper adjacent block (C) of the current block, the quantized AC coefficient  $QF_x [0][u]$  of the current block (X) equals to  $PQF_x [0][u] + MP_C[u] // QP_x$ , wherein  $QF_x [0][u]$  is a first row quantized AC coefficient of the current block (X); and the quantization scale  $QP_x$  is a quantization scale of the current block,  $PQF_x [v][0]$  and  $PQF_x [0][u]$  are inverse scan calculation results generated during a previous stage decoding process of the current block, and the operator  $//$  denotes a division operation with the result thereof rounded to the nearest integer.

[Claim 17] 17. The device of claim 16 further comprising:

a saturator electrically connected to the adder for saturating the summation  $QF [v][0]$  or  $QF [0][u]$  of the current block in a predetermined numerical interval.

[Claim 18] 18. The device of claim 17 further comprising:

a multiplier electrically connected to the saturator for a multiplying a quantized AC coefficient  $QF_x[v][u]$  of the current block (X) by a quantization scale  $QP_x$  of the current block to generate a current product  $MP_x[v][0] = QF_x [v][0] * QP_x$  or  $MP_x[0][u] = QF_x [0][u] * QP_x$  corresponding to each quantized AC coefficient of at least one quantized AC coefficient  $QF_x [v][0]$  or  $QF_x [0][u]$  of the current block;

wherein the current product  $MP_x[v][0]$  or  $MP_x[0][u]$  is stored in the storage device for predicting other blocks of the picture.

[Claim 19] 19. The device of claim 13 further comprising:

a saturator electrically connected to the adder for saturating the summation of the current block in a predetermined numerical interval.

[Claim 20] 20. The device of claim 19 further comprising:

a multiplier electrically connected to the saturator for multiplying a quantized AC coefficient of the current block by a quantization scale of the current block to generate a current product corresponding to each quantized AC coefficient of at least one quantized AC coefficient of the current block; wherein the current product is stored in the storage device for predicting other blocks of the picture.